CONFIRMED MINUTES

IHRA SIDE IMPACT WORKING GROUP

12th MEETING

INRETS, LYON, FRANCE

14-15 JUNE 2001

1 ATTENDEES

Keith Seyer	(Chair)	Department of Transport & Regional Services, Australia
Craig Newland	(Secretary)	Department of Transport & Regional Services, Australia
Dainius Dalmotas		Transport Canada
Richard Lowne		EEVC
Joseph Kanianthra		National Highway Traffic Safety Administration, USA
Stuart Southgate		OICA North America / AAM (proxy for Michael Leigh)
Minoru Sakurai		JASIC / JARI
Hideki Yonezawa		JMoT
Michiel van Ratingen		EEVC
David Zuby		Insurance Institute for Highway Safety
Sabine Compigne		INRETS
Dominique Cesari		INRETS

APOLOGIES

Takeshi Harigae (JASIC / JARI), Rainer Justen (OICA Europe) and Michael Leigh (OICA North America) all apologised for their inability to attend. Stuart Southgate attended on behalf of Mr Leigh to represent OICA North America.

Takahiko Uchimura (representing OICA Asia Pacific) has been promoted to a new position and will no longer participate in the IHRA Side Impact Working Group. Mr Nobuhiko Takahashi from Nissan has been appointed to replace Mr Uchimura. Mr Takahashi was unable to attend this meeting.

2 MODIFICATIONS TO AGENDA

It was agreed to add “Report from EEVC WG13” as a standing item to the agenda for future meetings.

Several other items were also added to the agenda:

A discussion on a new Terms of Reference for the group;

An update on the EEVC Side Impact MDB specification [EEVC];

Rear seat occupants [Japan];

Rear seat occupants [Australia];

Transport Canada tests using the IIHS barrier [Transport Canada];

US NASS data 1995-99 Model year vehicles – rear seat occupants [NHTSA]; and

US Child Injuries in Side Impact [NHTSA].

The following items were deleted from the agenda for this meeting:

DoTRS/TC/Ford parametric tests & IIHS barrier test [Australia];

Behaviour of aluminium honeycomb under combined axial and shear loads [Australia];

OICA information on pole size (diameter) for side impact tests.

The modified agenda has Document Number SIWG 128 Rev2.

3 MINUTES OF THE PREVIOUS MEETING

The draft minutes of the eleventh meeting, held in Geneva were amended. Mr Dalmotas agreed to provide information to clarify the drop heights used in the Transport Canada WorldSID evaluation tests (Item 5 of the minutes of the eleventh meeting). Mr Dalmotas also noted that a presentation to be given at this meeting regarding tests using the IIHS barrier would supersede that mentioned in Item 7.3 of the minutes of the eleventh meeting.
The amended minutes of the eleventh meeting have document number SIWG 127 Rev 2.

Mr Newland to send the minutes to John Hinch.

4 REPORT FROM IHRA STEERING COMMITTEE

The IHRA Steering Committee recommended that actions and decisions from each of the working groups should be posted on the public side of the IHRA website.
Mr Newland to extract actions and decisions from previous minutes and supply to NHTSA for the website.

The IHRA Steering Committee has decided:
IHRA should continue for two further 2 year periods;
The Advanced Frontal and Compatibility Working Groups should be merged; and
The Side Impact Working Group should continue.

The Steering Committee will no longer hold meetings in conjunction with WP29. There will be one meeting per year, with this meeting to be held in conjunction with the ESV conference each year of the conference. The meetings will be over a one week period, with reports from each working group (minimum 2 hours per working group report).
The Chairperson from each working group is to report to GRSP to feed IHRA work into this forum. This is subject to invitation from GRSP and the inclusion of an appropriate GRSP agenda item.
Mr Seyer to write to Mr Lomonaco and offer to make an IHRA Side Impact presentation to GRSP.

Mr Cesari mentioned that each IHRA working group needs to determine when and how to establish links with other working groups. Mr Seyer and Mr Kanianthra both noted the need for the Side Impact Working Group to establish links with the Compatibility Working Group. It was agreed that the Side Impact working group should report to the Compatibility working group and vice-versa at least annually. As a minimum, this should be done at the Steering Committee meeting.

The Biomechanics working group is not to be limited strictly to dummies and should have specific tasks set.

There has also been a proposal to create a working group on event data recorders.

5 REPORT FROM WORLDSID TASK GROUP

Mr Cesari presented a summary of recent WorldSID activities.
Mr Uchimura is no longer the Asia-Pacific Chairperson and has been replaced by Mr Takahashi.

The prototype WorldSID dummy was on display at the ESV conference and a leaflet was produced for distribution at the conference. There was quite a lot of interest in the dummy at ESV.
Work is continuing towards the pre-production prototype. Redesign is due to start mid 2001.
T9790 tests are to be / have been conducted at Transport Canada and NHTSA. The results are promising.
The dummy is currently at INRETS, and will be shipped via the Netherlands to the USA. Tests will be conducted to proposed IHRA Biomechanics requirements (sled tests) as well as pendulum tests. The dummy will then be sent to Japan for a workshop on installation and use of the dummy. The dummy will then be shipped to Europe for SIBER tests.
It is intended to redesign the dummy prior to European tests, based on the TR9790 test results from Transport Canada and NHTSA. The dummy will then be assumed to meet the ISO criteria (TR9790) and Europe will concentrate on IHRA requirements, particularly the shoulder re-design. Mr Seyer commented that he had spoken with Steve Moss, who indicated that the shoulder design (and consequently the response) was constrained by the need to package a 3-axis shoulder load cell. The inertial effects of the mass of the load cell cause a problem with shoulder deflection, and Steve Moss believed that the shoulder was not too stiff, although a slight stiffness revision may be required. The need for a load cell would depend on its intended use – if the load cell was simply to determine biofidelity, then it could be used for checking the dummy and then would no longer be required. However, the problem would be more difficult if IHRA wished to measure shoulder loads during full scale tests and assess with a performance limit.

Progress is currently running according to planned timelines.
Dummy development is planned from 2nd quarter of 2002 through to 2003.
Between 8 and 12 dummies will then be manufactured for evaluation.

There is currently no project manager. The call for proposals was not accepted due to the poor quality of proposals. Progress has been a little slow without a manager.

Pricing for the dummy is approximately USD$300,000 for the pre-production dummy including 63 sensors and 2 data acquisition units.

Mr Seyer informed the group that he had written to Mr Mertz (Chairman of the ISO working group on Anthropomorphic Test Devices TC22/SC12/WG5) to request the development of a 5th %ile WorldSID. The ISO has concerns about developing a 5th, particularly after the funding problems experienced with the 50th. A new work item has been proposed to SC12. Mr Seyer requested IHRA members to canvass their ISO representatives to support the development of a 5th %ile WorldSID.

6 REPORT FROM IHRA BIOMECHANICS WORKING GROUP

The IHRA Biomechanics Working Group (BWG) met for 2 hours on 07 June 2001 after the ESV conference at the RAI in Amsterdam.
A new Terms of Reference was discussed. It was agreed to rewrite and expand the mission and objectives to encompass more than just dummy development and include activities such as:
acting as a forum to coordinate international research;
providing biomechanical expertise to other IHRA Working Groups; and
developing a strategic long-term plan for biomechanical research and priorities.

Jac Wismans was tasked with specification of weighting factors for biomechanical response corridors.

The IHRA Biomechanics Side Impact report was scheduled for December 2001.
The group also plans to meet more frequently and with longer meetings.
The next meeting was planned to be held on 31 August 2001 at INRETS. This date has since been changed to Monday and Tuesday, October 15 and 16, at the beginning of the week following the IRCOBI Conference.
A meeting was also planned to be held 2 days before the Stapp conference in San Antonio. This date has now been changed to Sunday 18 November 2001 (the day after the Stapp conference.

7 TERMS OF REFERENCE

The Terms of Reference for the IHRA Side Impact Working Group were discussed. Comments received from Mr Lowne and Mr Kanianthra had been incorporated. Mr Dalmotas asked what was meant by “final” when referring to test procedures under development. He pointed out that some external activities such as dummy development may be incomplete, but beyond the control of the IHRA SIWG. The wording was slightly revised to reflect this. Mr Newland to send agreed Terms of Reference (Document SIWG 138) to John Hinch and to members with the minutes.

8 PRESENTATION OF ACCIDENT STUDIES

8.1 Japanese Accident Analysis of Side Impact Injuries by Gender and Age

Mr Sakurai presented an analysis of side impact injuries in Japan (Document SIWG 129). It was pointed out this data was collected for fatal and serious injuries (defined as having at least 30 days treatment), but that injuries (and not injured

occupants) were recorded and hence multiple injuries on a single occupant would all be counted. The data was recorded for car to car side impact crashes involving passenger cars and mini—vans for the years 1994-1998. No discrimination between struck and non-struck side seating position was available for rear seat occupants.
The analysis showed that the proportion of males to females in front seating positions was around 50% to 50%, whereas the ratio was approximately 30% - 70% for rear seat occupants. Seatbelt wearing is not mandatory for rear seat occupants.

Mr Dalmotas requested that Japan re-analyse the data using only fatalities as this may show a greater percentage of front seat female fatalities compared to front seat males. The larger number of female fatalities has been the general trend in other global accident studies and Mr Dalmotas suspected that the non-fatal data may be masking this trend.

8.2 Overview of the current US Side Impact Environment

NOTE: At the meeting held on 7-8 December 2001 in Geneva, Mr Kanianthra advised that the NHTSA is conducting further analysis and that the following information should be treated with some caution. The results of the additional analysis will be presented later.

Mr Kanianthra presented an overview of the current US side impact environment based on weighted NASS data (Document SIWG 130).
The breakdown of striking objects for struck side fatal crashes was shown to be 20% narrow object, 21% large SUV/pickup, 24% large car, 17% Compact SUV/pickup, 4% small car.
There was a total of 948,000 side impact tow-away crashes in the sample. In these crashes, 47.7% of occupants were on the struck side. For AIS 3+ injuries, 65% of occupants were on the struck side.

Head and chest injuries were shown to be predominant when the striking vehicle was an LTV. Pole impacts also show head and chest injuries are most common. Chest injuries predominated when the striking vehicle was a car.
Mr Lowne commented that lower extremity injuries seemed unusually low for pole impacts, and that Europe sees a lot of these.

The median mass of striking vehicle was calculated for crashes in which MAIS3+ injuries were recorded in the struck car. The results were 2910 lbs for passenger car as the striking vehicle, and 3902 lbs for LTVs.
Mr Dalmotas cautioned that these injuries are due to geometry and not mass, but noted that the vehicles with the most injurious geometry were also the heaviest.

For cases in which MAIS3+ injuries were recorded in the struck vehicle, the following was found:

	Struck by car	Struck by LTV
Median lateral delta-v	17 mph	20 mph
Median longitudinal delta-v	6 mph	12 mph

Male	49%	39%
Female	51%	61%

Mr Southgate made the point that the females in this sample would not all be 5th percentile. He also suggested that causes of injury such as the armrest could be tested by other than a full scale crash test.
Mr Dalmotas replied that localised loading is the problem, not just isolated components or features and that a full scale crash test was needed in order to assess this.
Mr Southgate indicated a desire to understand the root cause of the predominance of females being injured, particularly since not all the females would be 5th percentile.
Mr Dalmotas argued that small changes in seating position and stature resulted in a large difference in injury result because vehicles are over-optimised for the 50th percentile male seated in mid position.

Mr Kanianthra noted that the US data did not show a high percentage of injuries to the elderly.
Mr Lowne stated that occupants over the age of 60 represented 18% of MAIS 3+ injuries in the UK, 27% of MAIS 3+ in Sweden and 16% of MAIS 3+ in Germany.

8.3 Australian Rear Seat Occupancy Rates

Mr Newland presented information from Australian fatal crashes, which showed the rear seat occupancy rates (Document SIWG 131). There were 3225 occupants in the sample, of which 522 were rear occupants (16% of the sample), however, not all of these were correctly seated (for example, some were known to be standing, lying down or seated in another passenger's lap). There were 229 occupants (7.1%) who were known to be *correctly seated* in the rear seat.

9 TEST RESULTS AND TEST MATRICES

9.1 Vehicle Deformation in Real World Side Impact Crashes [D. Zuby, IIHS]

David Zuby presented the results of an analysis of side impact vehicle crashes (Document SIWG 132). The data sample was restricted to fatal and AIS 3+ (non fatal) vehicle to vehicle side impact crashes with a principal direction of force between 2-4 or 8-10 o'clock and in which only the occupant compartment was damaged. The sample was further limited to 1992-or-newer model year vehicles. The age of occupants was also restricted to be 13-64 years old. The sample comprised 68 injury cases and 21 fatal cases.

Mr Dalmotas commented that approximately 40% of injuries in side impact are to occupants of age 60 years or more and that this may bias the IIHS analysis.

David commented that side impact protection is predominantly driven by regulatory tests, both MDB and pole. FMVSS 214 and ECE R95 MDB tests both engage the sill, but this is not commonly seen in real world crashes. The IIHS analysis looked at the type of vehicles involved in the crashes, vehicle mass, impact direction, delta v, pillar loading and door sill loading.

The analysis of injury cases showed that the struck vehicle was usually a passenger car (92% of cases) and the striking vehicle was a passenger car in 63% of cases and an SUV in 25% of cases.

The fatal data showed the struck vehicle was usually a passenger car (85%) and that a passenger car represented the striking vehicle in 24% of cases; SUVs in 10% of cases and pickups were the striking vehicle in 47% of cases.

The conclusion from these figures was that the struck vehicle was predominantly a passenger car and that pickups and SUVs were over-represented as striking vehicles.

The analysis also showed that crabbed and perpendicular impact directions were equally common.
The A, B and C pillar were rarely engaged in the sample cases and pillar involvement was therefore considered uncommon in real world crashes.
The real crash delta v was noted to be considerably higher than that seen in ECE or US MDB tests.

It was concluded that the ECE and US MDB mass and barrier height are too low to represent the striking vehicles seen in this study. The ECE and US MDB tests generate a lower delta v than seen in this study, and the FMVSS 214 test engages the vehicle pillars unlike a real crash.

These conclusions provided the basis for the development of a test procedure to simulate the crash conditions observed in these real world crashes.

9.2 IIHS Side Impact Crashworthiness Evaluation Development Program [David Zuby, IIHS]

David Zuby presented information (Document SIWG 133) on the development of a side impact test procedure designed to simulate the crash conditions observed in the real world crashes of a IIHS study.

The test procedure is intended to provide consumer information based on a severe side impact test environment.

A profiled barrier face and trolley specification was developed based on measurements of 15 vehicle models. These models represent 68% of new SUV sales.

Mr Seyer asked about future plans for the barrier.
Mr Zuby replied that IIHS would select various vehicle models (both good and poor LINCAP performing vehicles) and assess barrier performance on these vehicles.
Version 3 (with aluminium head impact plate) is the latest revision of the barrier face design. Adrian Hobbs has suggested to make the barrier softer (less stiff) to

prevent vehicles being designed to “fend off” the barrier. There was also a suggestion to extend the aluminium head impact plate across the entire barrier face instead of having a right and left handed variant. IIHS and Transport Canada were both happy with this proposal.
IIHS are planning to be able to conduct consumer information tests with this barrier within 12 months (subject to feedback that may necessitate redesign).
Mr Dalmotas commented that he believes that the IIHS barrier is currently putting too much load through the dummy shoulder.

NHTSA are not yet convinced that the IIHS barrier is a good barrier and NHTSA will conduct tests on various vehicle models to assess the barrier (3 tests have been conducted already). However, NHTSA believes that this type of barrier face is required to improve side impact protection in the USA.

Japan has not yet conducted any tests using this barrier, but has purchased 100 barrier faces.

Mr Southgate was not aware of industry plans to test using this barrier.
Mr Zuby commented that Volvo, BMW, Volkswagen and Honda were all conducting tests using the barrier.

The EEVC has no current plans to test using this barrier. The barrier would probably only be looked at for interest and not considered for Europe.

9.3 Transport Canada Side Impact Research Progress Report [Transport Canada]

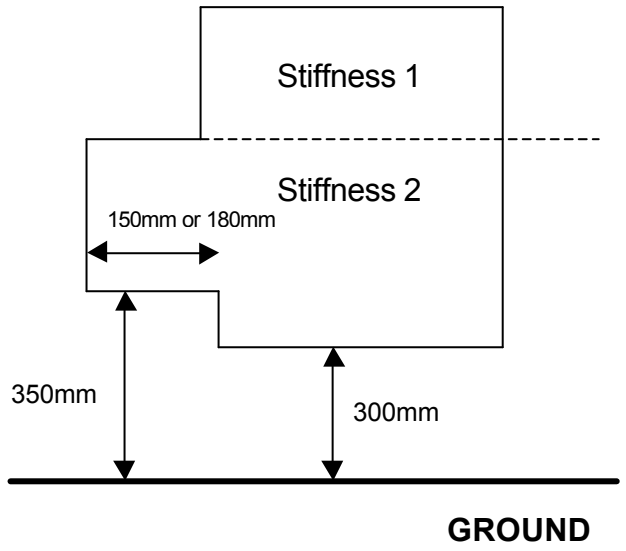
Mr Dalmotas presented a Progress Report on TC Side Impact Research (Document SIWG 134).
Tests were conducted using the IIHS Side Impact barrier face, with a trolley mass of 1500kg. Both perpendicular and crabbed tests were conducted.
Mr Dalmotas commented that in side impact crash tests using the SID IIs dummy, head-torso side airbags work well and contain the head. The torso side airbag also spreads load evenly across the ribs. In comparative tests without airbag, some of the ribs were noted to have high injury risk. The injury risk on these ribs is usually reduced by a torso side airbag, but the injury risk on the other ribs may be increased.
In side impact crash tests using a Ford Explorer to impact Toyota Camry (both with and without side airbag) the difference between airbag and non-airbag is difficult to distinguish as all the results predict severe injury. Mr Dalmotas commented that the Explorer overpowers the Camry and the results are swamped.

Mr Dalmotas provided some evidence that it is common in real world crashes for occupants to suffer both thoracic and head injuries.
Mr Dalmotas also provided an example of a non-fatal pole crash, in which the occupant sustained hip fracture. The vehicle was equipped with a head/torso side airbag.

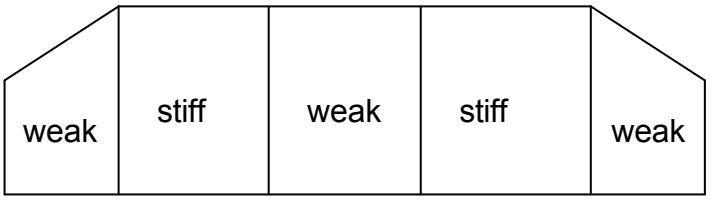
Transport Canada plan to conduct further tests using the Camry with SID IIs dummy. They also plan to run a Landrover Freelander as a bullet vehicle, and tests using the IIHS barrier both perpendicular and crabbed.

9.4 TRL views on a possible side impact barrier [Lowne]

Mr Lowne provided a Transport Research Laboratory view of a possible side impact barrier (Document SIWG 135).
The CCIS database for vehicle to vehicle crashes shows a side impact intrusion profile with a “dimple” at the B-Pillar.
Crabbing of the mobile barrier seems to reduce injury severity on the driver.
The risk from a perpendicular impact exceeds that of a crabbed or oblique impact.
TRL is currently considering a barrier face with the following cross-section:



The barrier could also be contoured to avoid contact with the A and C pillars (overhead view):



The intent is not to reproduce a particular accident scenario, but rather generate a set of conditions that encourage remedial measures in the struck vehicle that will work in a range of crashes.

Mr Dalmotas commented that the IIHS barrier replicates a Camry bullet vehicle and also a Ford Explorer bullet vehicle.
Mr Lowne and Mr Seyer questioned how this could be possible when the Explorer and Camry are so different.

Mr Dalmotas explained that his comments were based on struck vehicle static intrusion profiles.
Mr Lowne was not content to rely on static intrusion profiles to correlate similarity between bullet vehicles.

Mr Kanianthra stated that he believed wheelbase to be important and that the current EEVC barrier was too narrow.
Mr Lowne and Mr Seyer suggested that door opening size or A/B/C pillar distances could be more appropriate because these are not directly related to wheelbase.

The discussion then turned to the barrier design under consideration by TRL. The need for a lower lateral simulation was questioned. If this is not necessary, then the barrier resembles the geometry of the IIHS barrier. The need to have a stiffness distribution and progressive stiffness was also questioned.

There was some discussion about pre-empting the frontal structures of future cars, based on anticipated compatibility requirements leading to multiple load paths and strong interconnections. This could mean that a side impact barrier may not be based purely on previous or current model vehicles. It was agreed that research was needed to determine if a barrier designed on such "future" vehicles (based on compatibility requirements) would also provide safety benefits for new vehicles when side impact striking vehicles are from the existing fleet.

Mr Dalmotas commented that he did not believe it was necessary to use a non-homogeneous barrier.

9.5 US Child Restraints [NHTSA]

Mr Kanianthra presented some US data on child injuries and fatalities (Document SIWG 136). He presented 9 years of data for fatalities involving children less than 1 year old, 1-3 years old and 4-8 years old.
There were approximately 90 fatalities per year for children of all ages in side impact crashes. More children were killed in the front seat than the rear seat.
The data showed around 1000 children (all ages) are killed each year in the US in all crash modes.
Mr Kanianthra commented that the US has a side impact problem for children. Transport Canada has tested the Q3 dummy in a child restraint. The injuries recorded were much less severe than for a SIDIIs dummy under similar impact conditions. It was thought that if the SIDIIs can be protected, then protection for 12-13 year old children should be the same (since the anthropometry of the SIDIIs is similar to a 12-13 year old child) and that children less than 12 years old would be even safer.

Mr Kanianthra asked the group for information on child restraint systems used elsewhere in the world. Mr Seyer suggested testing US child restraints to Australian Standard AS1754. Mr Seyer and Mr Newland to provide information on Australian child restraint requirements to Mr Kanianthra.

Mr Dalmotas suggested computing survival rates from the fatal data (determining how many occupants from a given vehicle survived compared to those fatally injured).

10 FUTURE WORK PROGRAM FOR IHRA SIWG

There was a discussion of issues to be investigated by the group and tasks were assigned to members.

MASS
The NHTSA favour a mobile barrier mass between 1376kg – 2000kg. Transport Canada favours 1500kg. The EEVC would support a mass of up to 1500kg. Australia would also support a mass of 1500kg. Japan would like to see a lower trolley mass as their average vehicle fleet mass is 1150kg.
It was decided that there was no requirement to investigate mass at the moment.

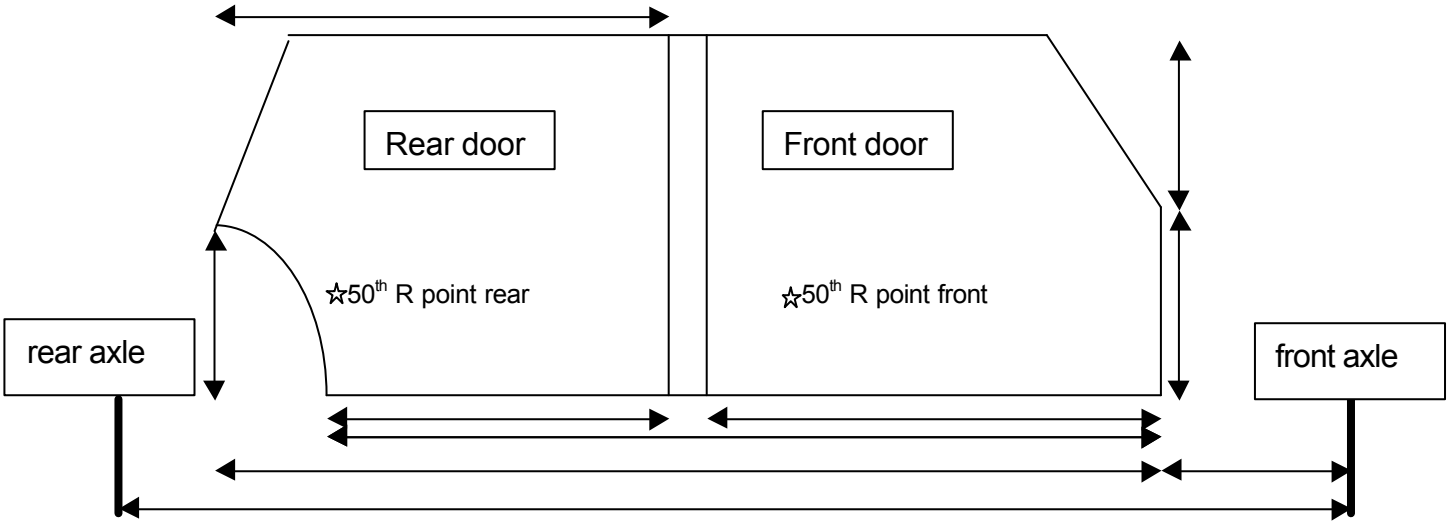
HOMOGENEITY
The issue of lateral and vertical stiffness distribution and through-depth stiffness of the barrier face was discussed.
Load cell wall data was thought to be an appropriate means to determine whether a barrier face was sufficiently “car-like”.
NHTSA was tasked with conducting load cell wall tests for the IIHS barrier in both the perpendicular and crabbed configuration. These should be “low speed” tests (the same impact velocity as the EEVC WG13 test).
OICA (Mr Southgate) was tasked with providing the geometry of structural members (bumper cross beam, radiator mounting panel, longitudinals and subframe) and load cell wall data for 5 vehicle models: Laguna II, Mondeo, Focus, Corsa, Taurus and Volvo S80.
EEVC (WG13) was tasked with providing results from low speed load cell wall tests for vehicle crashes (with a small amount of crush – similar to that observed for side impact bullet vehicles) and load cell wall data for the EEVC proposed profiled aluminium honeycomb.
Mr Kanianthra also offered to provide NHTSA results of tests using the load cell moving deformable barrier (LCMDB) with FMVSS214 honeycomb at test speeds of 33.5 mph and 37.5 mph.

REAR DUMMY
The need for a rear dummy was discussed.
Transport Canada has been conducting tests with the IIHS barrier aligned more rearward to load the rear dummy while maintaining driver loading.
It was speculated that US vehicles may have longer wheelbase, greater distance between the A and C pillars and larger door openings.
All members were tasked with providing vehicle measurements to the group to allow comparison of US and European vehicles. This comparison should cover Minicars, Small, Medium and Large vehicles. The following vehicles were proposed:

	Europe	**US**	**Australia**
Minicar	Yaris, Corsa	Metro	
Small	Astra, Golf	Neon	

Medium	Mondeo, Laguna	Stratus	
Large	Volvo S80	Intrepid	Commodore
		Crown Victoria	Falcon
		Lincoln Town Car	
		Cadillac De Ville	

Measurements to be taken:



IIHS also offered to provide the data from the 15 vehicle profile measurements used to develop the IIHS barrier.
Australia was tasked with collating dimensional data of vehicles for the group.
The EEVC agreed to look at load cell data collected from behind the barrier on offset deformable barrier tests. This data may be of use in discussions within the side impact group.
The acceleration-time data from IIHS offset deformable barrier tests and Transport Canada side impact tests was proposed as a method to be used to determine the length of time during an offset test for which vehicle crush (and load) information is useful and relevant for side impact bullet vehicles. Transport Canada to undertake this work.

Mr Dalmotas also presented some results from Transport Canada tests using the IIHS barrier with a 1500kg trolley mass.

The SIDIIs HIC_{15} results were as follows:

		Driver	Pass
IIHS barrier Version 1 vs Camry	NORMAL	2800	400
IIHS barrier Version 1 vs Camry	CRABBED	1300	700
IIHS barrier Version 1 vs Maxima	NORMAL	350 (head torso airbag)	100
IIHS barrier Version 3 vs Accord	NORMAL	3500	500
IIHS barrier Version 3 vs Focus	NORMAL	600 (head torso airbag)	350

Mr Dalmotas cited anecdotal evidence that head contact for rear occupants is not often observed in the field.
Mr Kanianthra noted that NHTSA had conducted a test with the IIHS barrier into a Nissan Maxima (no side airbag) and recorded a HIC of 700 on the EuroSID dummy.

11 NEXT MEETING

The next meeting will be held 27-28 September 2001, hosted by the Department of Transport and Regional Services in Canberra, Australia. This meeting will be held in conjunction with a meeting of the IHRA Compatibility Working Group to be held 24-26 September 2001.

A possible meeting of the IHRA Side Impact Working Group was suggested to be held in Washington DC after the Stapp 2001 conference. The Stapp conference will be held in San Antonio, Texas, USA from the 15-17 November 2001. It was proposed to hold an ES-2 Steering Committee meeting on 19 November, and then an IHRA Side Impact meeting on 20-21 November. This is yet to be confirmed.

12 MEETING CLOSED.

CRAIG NEWLAND

22 April 2002